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Descriptions of known vocalisations of the Night Parrot *Pezoporus occidentalis*

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Abstract. Until recently, the only descriptions of Night Parrot *Pezoporus occidentalis* vocalisations were anecdotal reports from observers in the late 19th and early 20th centuries. The 2013 discovery of an extant population of Night Parrots in western Queensland led to the first contemporary descriptions, and further calls were described following the 2017 discovery of Night Parrots at a site in central Western Australia. Ongoing field studies have shown that the species has a complex repertoire and, although there are some similarities in vocalisations between sites, there is much spatial and temporal variation. It is likely that call recognition will be the primary means of detection for this cryptic species, underscoring the importance of cataloguing vocalisations across the species' range. Accordingly, we describe all known vocalisations from the three sites where Night Parrots are known to occur.

Introduction

The Night Parrot *Pezoporus occidentalis* was first recorded by Europeans in 1845 (Sturt 1845). Despite occurring throughout largely uninhabited arid central Australia, it had all but vanished by the early 20th century (Higgins 1999). Multiple searches throughout the 20th century (e.g. White 1913; Whitlock 1924) found little evidence of the Parrot's continued existence, although a trickle of unconfirmed reports and rumours hinted at its persistence (e.g. Powell 1970; Parker 1980). In 1990, the discovery of a dead Night Parrot beside a road in western Queensland (Boles *et al*. 1994) provided irrefutable proof that the species was extant, and in 2006 another dead bird, an immature female, was found in western Queensland (Cupitt & Cupitt 2008; McDougall *et al*. 2009). In 2013, naturalist John Young provided evidence of an extant population of Night Parrots in western Queensland, including the first known recordings of the bird's call (Koch 2013; Olsen 2018). In 2017, Night Parrots were detected at two sites in Western Australia (Hamilton *et al*. 2017; Jackett *et al*. 2017; Mills & Collins 2017).

The historical literature contains few descriptions of Night Parrot vocalisations. Various whistling calls are reported, including "a plaintive whistling note" (Mallee Bird 1908, p. 52; Menkhorst & Ryan 2015, p. 109), a "sweet low two-note whistle" (McGilp 1931, p. 70), and a "long drawn-out mournful whistle" (Wilson 1937, pp. 83–84). Both McGilp (1931) and Wilson (1937) reported that whistling calls were given in flight. Andrews (1883, p. 29) described Night Parrots giving a "very peculiar croaking note" resembling the "loud croak of a frog" when alarmed, and Bourgoin reported that a flushed bird uttered a "squeak, as if it were hurt" (Wilson 1937, p. 83). Young birds begging for food from an adult gave squawking calls (Wilson 1937). Murphy *et al*. (2017a) and Jackett *et al*. (2017) provided the first contemporary descriptions of Night Parrot vocalisations. These authors described several vocalisations recorded around active nests in western Queensland and central Western Australia, respectively. Calls described from Queensland included *peel*, *chirrup* and *prat* calls, a *croak* call that was apparently a contact call between individuals, and three vocalisations with a bell-like quality—*dink-dink*, *ding-de-ding* and *dee-de-dee-de*. From Western Australia, *croak* was reported, along with a *hollow whistle* and *didit* call.

Since the Night Parrot's rediscovery, intensive research in western Queensland has focused on its ecology (Murphy *et al*. 2017a,b). The birds roost and breed in patches of long-unburnt spinifex *Triodia longiceps*, apparently as dispersed pairs or small family groups. After sunset, they depart from their roosting areas and spend the night foraging, returning to their roost before sunrise. Each night before departure, and again in the morning following return to their roosting sites, the birds engage in predictable periods of calling that continue year-round (SAM, NPL unpubl. data). These calling periods occur in the first hour after sunset and in the 2 hours before sunrise. The calling periods are brief, sometimes lasting only a few minutes (SAM, NPL unpubl. data). In addition to these predictable calling periods, Night Parrots call more frequently during breeding, when calling at roosting/breeding sites occurs throughout the night. Birds also call occasionally at their feeding sites and when visiting standing water (SAM, NPL, JB unpubl. data).

Preliminary research from both sites in Western Australia indicate that calling behaviour is similar to that in western Queensland. Some vocalisations are also similar, whereas others appear to be unique

(Jackett *et al*. 2017; JB pers. comm.). Given the Night Parrot's extremely cryptic habits, this predictable calling behaviour is likely to provide the most reliable method of detection, as it does for its closest congeners the Eastern Ground Parrot *Pezoporus wallicus* and Western Ground Parrot *P. flaviventris* (Burbidge *et al*. 2007). For this reason, a complete catalogue of known Night Parrot calls will provide an important tool for further survey work, necessary to improve our knowledge of the species' distribution and status.

There have been several recent reports of possible Night Parrot calls from locations throughout Australia (e.g. Beaven 2017; Ison 2017). Although it is possible that some of these calls are of Night Parrots, there are only three regions where the presence of the species has been confirmed visually (sighting or photograph) and calls have been heard or recorded under circumstances that make it extremely unlikely that they are of any species other than the Night Parrot. These regions are the Channel Country of western Queensland, the East Murchison district of central Western Australia, and the Great Sandy Desert of northern Western Australia. This paper collates existing data from these regions at the time of writing (January 2019), and provides descriptions of all known Night Parrot vocalisations, including calls of nestlings and fledglings. We also present brief analysis of similarities between a call of the Night Parrot and a call of the Pallid Cuckoo *Heteroscenes pallidus*.

Study area and methods

All vocalisations described in this paper were recorded from the Channel Country of western Queensland, the East Murchison district of central Western Australia, or the Great Sandy Desert of northern Western Australia.

Vocalisations were recorded on one of three different models of autonomous recording unit (ARU): Songmeter SM2, SM3 or SM4 (Wildlife Acoustics Inc., Concord, Massachusetts, USA). To obtain recordings of Night Parrot calls, ARUs were set to record from sunset until sunrise, under a variety of circumstances. Some were left *in situ* at known roosting sites for several years in order to understand site occupation, whereas others were opportunistically placed for shorter periods at sites where Night Parrots had been detected roosting or breeding or were suspected to be drinking or feeding.

ARUs recorded sound files in .wav format, and these were scanned for calls by manual listening, manually scanning spectrograms, or using SongScope automated signal recognition software (Wildlife Acoustics Inc., Concord, Massachusetts, USA). Spectrograms were produced in R (R Core Team 2018) using the package 'seewave' (Sueur *et al*. 2008). Examples of the calls described in this paper are posted on the Night Parrot website (www.nightparrot.com.au). Examples of all calls described for the first time in this paper have been lodged with the Australian National Wildlife Collection.

A secretive and cryptic nocturnal species, the Night Parrot is rarely observed vocalising. This presents a challenge when trying to identify the source of any suspected call. Ethical considerations preclude the regular use of techniques such as call-playback, spotlighting and daylight flushing in and around known Night Parrot populations, making attribution of unknown vocalisations difficult. Night Parrots have never been directly observed giving some of the calls described in this paper, but in each case a call has been heard multiple times and/or in association with other calls known to be Night Parrot calls. Although it is extremely unlikely that any of the vocalisations described herein are of any species other than the Night Parrot, we acknowledge a low probability that a vocalisation has been mistakenly attributed to the Night Parrot.

Results

Descriptions of known Night Parrot vocalisations

We describe all known vocalisations here in four categories: whistles, bell-like calls, croaks, and nestling/fledgling calls. Key information for all whistle, bell-like and croak calls is presented in Table 1 and for other calls below. Spectrograms of all whistle and bell-like calls, and *croak* are presented (Figures 1–11). In some cases, the same spectrogram shows different calls recorded at different times for ease of comparison and efficiency.

Further notes on the Night Parrot's hollow whistle

The single-note *hollow whistle* (Figure 1) is very similar to the Pallid Cuckoo's 'hoarse whistle' (the latter described in Higgins 1999). Separating the calls has proven problematic, especially as the Cuckoo occurs in similar habitats (BRG pers. obs.) and often calls at night. The peak frequency (~2.1 kHz) and duration (~0.6 seconds) of the Cuckoo's hoarse whistle closely match those of known *hollow whistle* recordings (BRG pers. obs.). However, the Cuckoo call typically has a broader frequency range, giving the call a distinctively harsh or aggressive quality. This differs from the Night Parrot's *hollow whistle*, which has a narrower frequency range, producing a thinner, more clean-sounding whistle. The Cuckoo call is usually slightly sinuous in shape when viewed in a spectrogram, giving the call a 'wavy' quality (Figure 3). This is often accentuated by the presence of an inflection at the start and/or end of the call. The strength of the call, and therefore distance of the bird from a sound recorder or observer influences the clarity of these features and, consequently, faint calls in particular can be difficult to assign to Pallid Cuckoos or Night Parrots with confidence.

Night Parrot nestling and fledgling vocalisations

Rasp

This call has only been heard given by nestlings when a nest is approached by an observer. Sometimes the nestlings remain silent when the nest is approached but, if given, the call commences only when the observer is within ~1 m of the nest. The call is a low, drawn-out *rasp*, similar to the begging call of a fledgling Rainbow Lorikeet *Trichoglossus moluccanus* (Higgins 1999), but lower and more drawn out. Each *rasp* lasts *c*. 3 seconds, and is repeated continually until the observer departs.

Table 1. Summary of the key characteristics for all known 'whistle', 'bell-like' and 'croak' vocalisations ('calls' for brevity). Locations: CC = Channel Country, Queensland; EM = East Murchison, Western Australia; GSD = Great Sandy Desert, Western Australia. ANWC = Australian National Wildlife Collection references.

Call	*Description*	*Duration (sec.)*	*Peak frequency (kHz)*	*Locations*	*Comments*	*ANWC*
Whistles						
Hollow whistle Figures 1–2	Loud, forceful whistle. Calls from EM have downwards 'hook' at start. Calls from CC have sharp upwards hook at end. 2- and 3-note variations known.	0.5–0.6	~2.0	CC, EM, GSD	Loud call that carries several hundred metres in still conditions. Very similar to Pallid Cuckoo's 'hoarse whistle' (Figure 3). Detections based solely on this call require additional evidence.	X49078 X49080 X49088 X49089 X49090 X49091
One-note and *two-note trills* Figure 4	May consist of 1 or 2 'notes', each of several much shorter notes given as a rapid trill. Sounds like a ringing telephone.	Each note: 0.3	~2.2	CC, GSD	Sequence of shorter notes varies between CC and GSD calls, but overall sound is similar.	X49092 X49093 X49094
Two-note, *three-note* and *four-note whistles* Figure 5	Mellow whistle usually of 2 notes: first note usually longer than second; notes usually of same frequency, but second sometimes slightly higher or lower than first. *Three-note whistle* is similar, but longer initial note is followed by 2 shorter notes, slightly higher than first note. *Four-note whistle* (previously described as *dee-de-dee-de* in Murphy *et al*. 2017a) consists of 2 consecutive *two-note whistles*.	Total duration of *two-note whistle:* 0.4	2.1–3.0	CC. Similar calls possibly detected from EM.	Most calls at mid to lower end of frequency range. *Two-note whistle* is commonly heard at CC sites.	X49095 X49096 X49097
Toot Figure 6	Short, soft, low, single-note whistle.	0.1	~1.8	CC	Known from only one CC site, and recorded regularly there over past 2 years but, interestingly, not before despite intensive acoustic monitoring.	X49098
Short whistle Figure 6	Short, sharp whistle. When heard well, it has slight pulses at beginning and end, apparent on a spectrogram.	0.2	~2.1	EM	Much less commonly heard than other calls at EM site.	X49099
Peel Figure 7	Short, slightly upslurred whistle, similar to call of a small wader.	0.2	~2.4	CC	Apparently associated with breeding. Only known from one breeding attempt in 2016, and a possible breeding event in 2014. *Peel*, *chirrup* and *prat* were all given by the non-incubating bird as it visited the nest.	X49085

Table 1 continued

Call	*Description*	*Duration (sec.)*	*Peak frequency (kHz)*	*Locations*	*Comments*	*ANWC*
Whistles						
Chirrup Figure 7	Mellow, slightly downslurred call, with a grating quality similar to call of Masked Lapwing *Vanellus miles*.	0.3	~3.6	CC	Apparently associated with breeding, and known from only one breeding attempt in 2016.	X49081
Prat Figure 8	Very similar to 2-note whistle of Australian Pratincole *Stiltia isabella*.	0.2	~2.2	CC	Rarely recorded. Possibly associated with breeding. Occasionally, similar calls are heard, but not in circumstances definitely attributable to Night Parrot.	X49086
Hook Figure 8	Short, low whistle, briefly upslurred at the beginning before levelling out.	0.2	~2.0	EM	Heard only once, amid a sequence of *hollow whistle* and *croak* calls.	X49100
Bell-like calls						
Ding-de-ding Figure 9	3-note call with a strong initial note, followed by 2 shorter notes, the first of higher frequency and the second of the same frequency as initial note.	0.4	First and last notes: ~2.8; middle note: ~3.8	CC	Loud call that carries several hundred metres in still conditions. Musical, with chime- or flute-like quality.	X49079
Dink-dink and *dink* Figure 9	1 or 2 clear bell-like notes. Usually each note of *dink-dink* call is of the same frequency, but second may be slightly higher or lower.	Total duration of *dink-dink* call: 0.4	2.2–3.1, typically ~2.5	CC	Commonly heard at all CC sites. Can be quite loud, but also given softly. Similar in quality to the bell-like call of Bell Miner *Manorina melanophrys* (Menkhorst *et al*. 2017).	X49083 X49101
Didit Figure 10	Rapid 2-note call, like beeping of small electronic equipment. Sometimes given multiple times in quick succession.	Total duration of single *didit* call: 0.2	2.2–3.1	EM, GSD	Calls recorded from EM all ~2.2 kHz (and probably all from same individual). Calls from GSD all 2.5–3.1 kHz.	X49102 X49103
Croaks						
Croak Figure 11	Short, buzzy, relatively high-pitched call, very similar to the *tjik* of Tawny Grassbird *Cincloramphus timoriensis* (Menkhorst *et al*. 2017). Often given several times in quick succession. Sometimes a quieter, lower-frequency version.	Duration of single note: 0.1; sequence of multiple calls may last several minutes.	Range: 1–10; peak: 3.5–4.0	CC, EM, GSD	Commonly heard when two birds are apparently in close proximity, or in response to other calls. Sometimes given when a bird is disturbed, either from daytime roost, or in the open at night.	X49082 X49087
Gruk	Very soft, barely audible clucking call.	0.1	~1.0	EM	Known only from one instance in the EM. A bird landed very close to a recorder and gave a series of these very soft calls, among *hollow whistle* and *croak* calls.	X49104

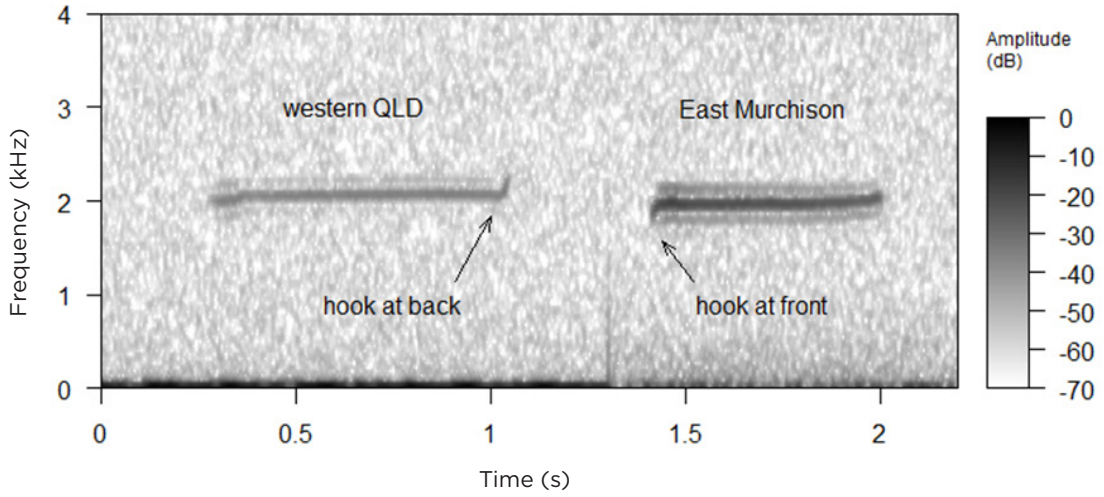

Figure 1. Comparison of *hollow whistle* calls from western Queensland and the East Murchison district of Western Australia.

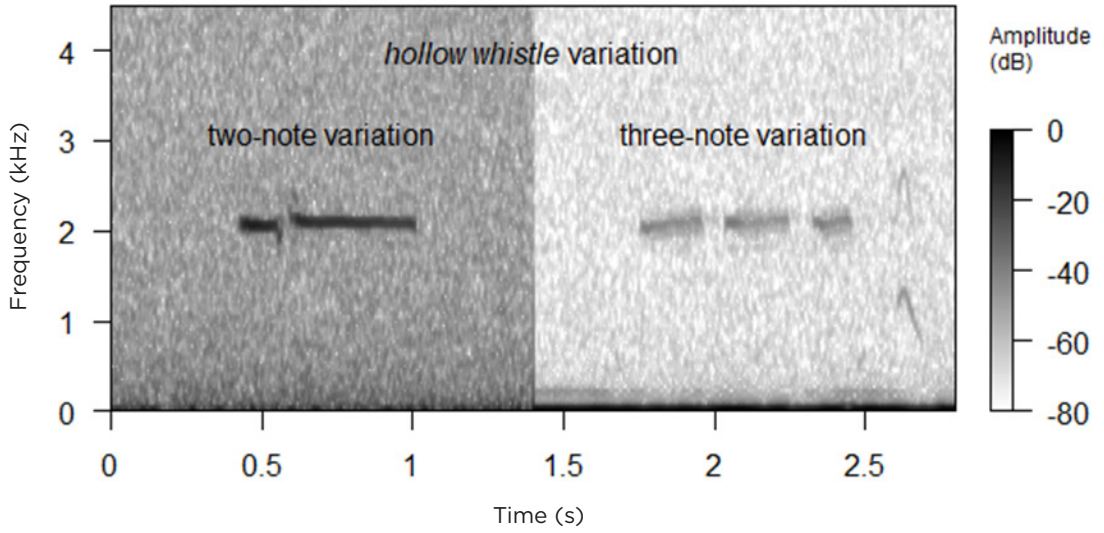

Figure 2. Two- and three-note variations of the *hollow whistle* call, from the East Murchison and Great Sandy Desert, respectively. The call to the right of the three-note variation (at 2.6 seconds) is of an Australian Owlet-nightjar *Aegotheles cristatus.*

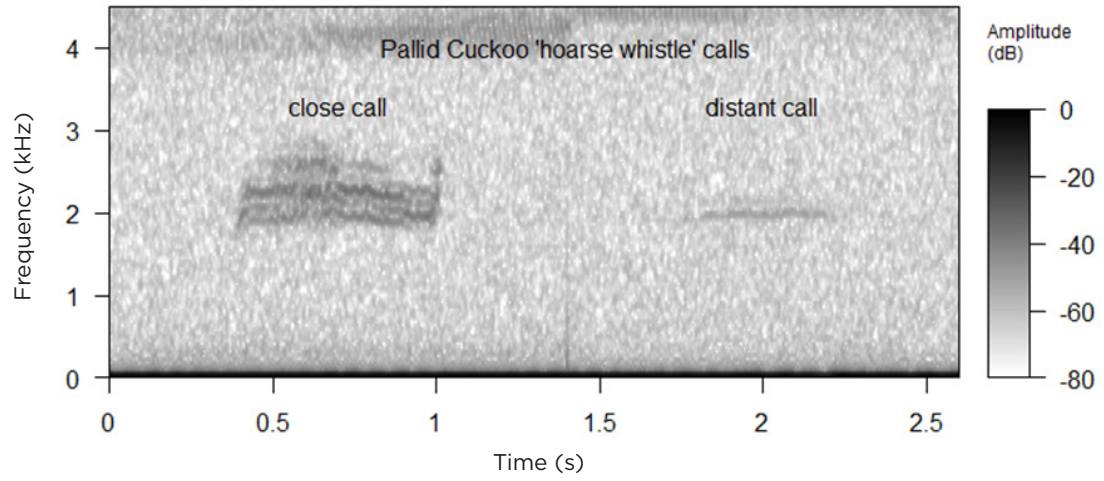

Figure 3. Comparison of two different Pallid Cuckoo 'hoarse whistle' calls from north-western Western Australia. The call on the left shows typical breadth of frequency, a sinuous shape, and hook at the end similar to *hollow whistle* calls from western Queensland. The call on the right is distant from the recorder, appearing narrower and more uniform in frequency, similar to a Night Parrot's *hollow whistle.*

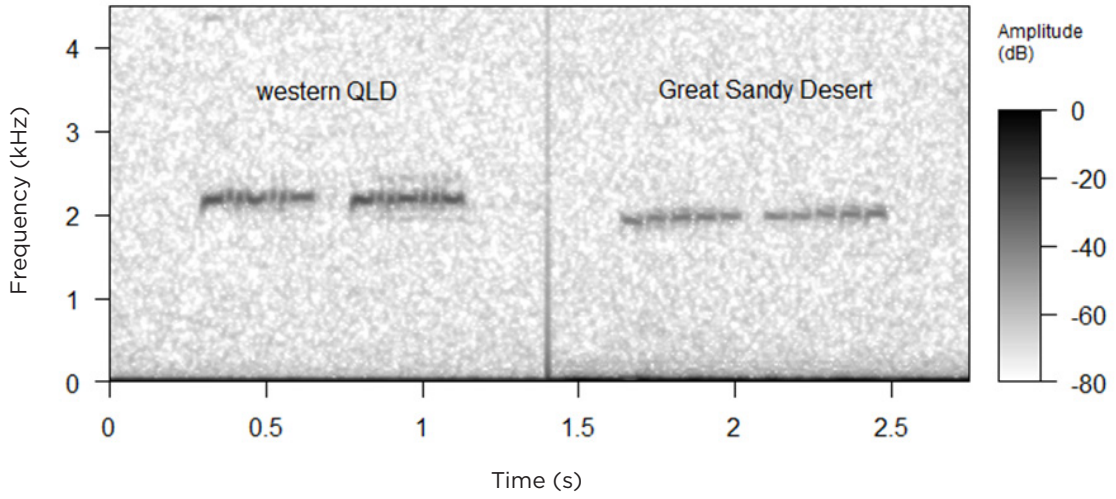

Figure 4. Comparison of *two-note trill* calls from Queensland and Western Australia. Sometimes a one-note version of the call is given. Each 'note' of the call actually consists of a sequence of much shorter notes, resulting in a trill-like sound. The shorter notes vary in length in the western Queensland call, but are all the same length in the Great Sandy Desert call.

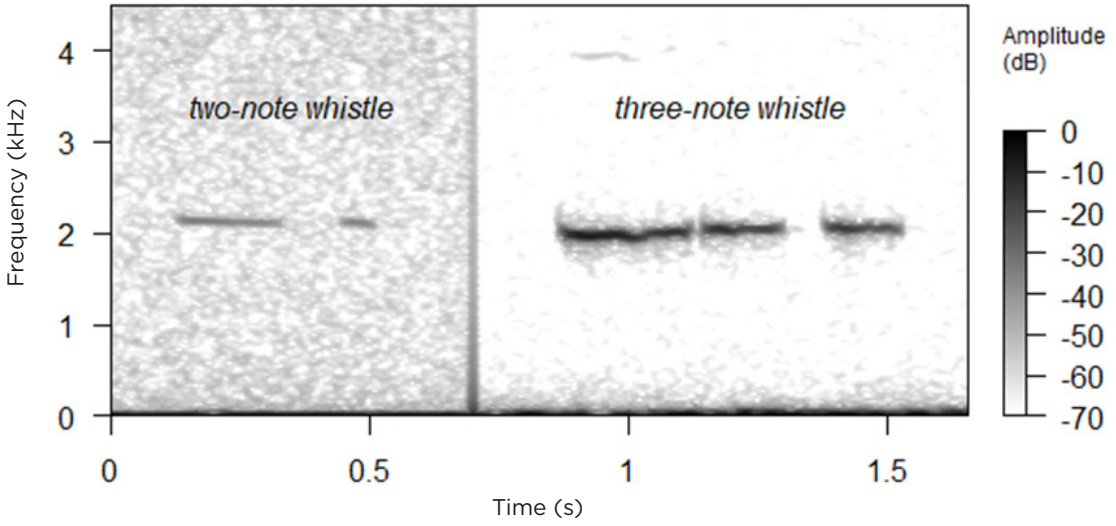

Figure 5. A typical *two-note whistle* call on the left, and a *three-note whistle* call on the right. The bird giving the call on the right was closer to the recording device, hence the bolder representation. Both calls are from western Queensland.

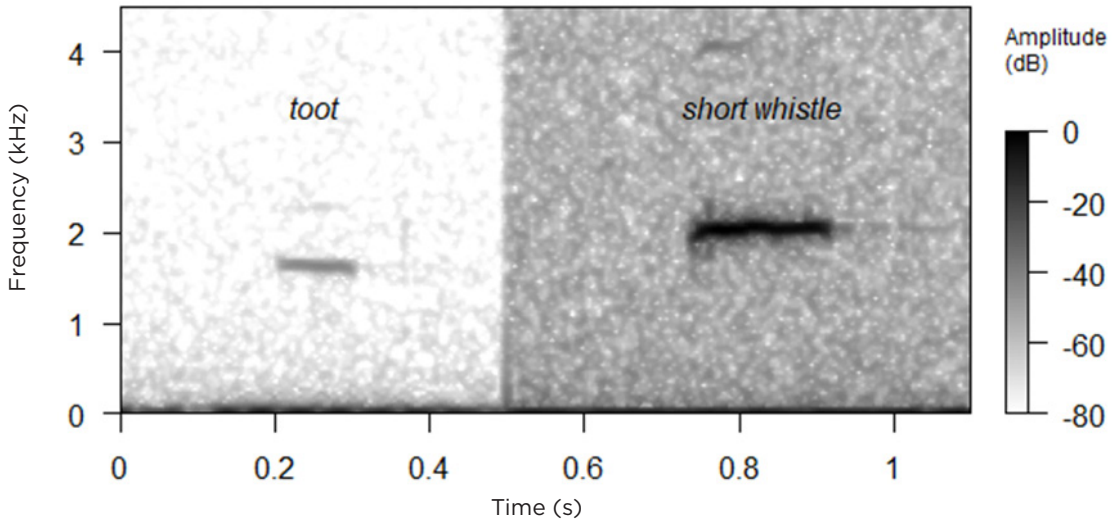

Figure 6. A *toot* call from western Queensland on the left and *short whistle* call from the East Murchison on the right. Both are very simple calls.

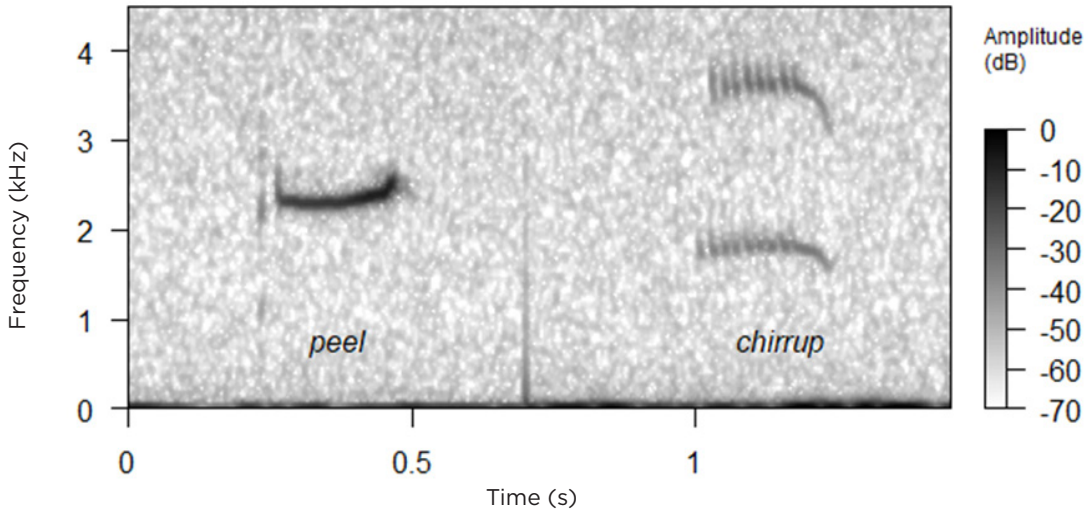

Figure 7. A *peel* call on the left, and a *chirrup* call, with noticeable harmonics, on the right. Both calls are from western Queensland.

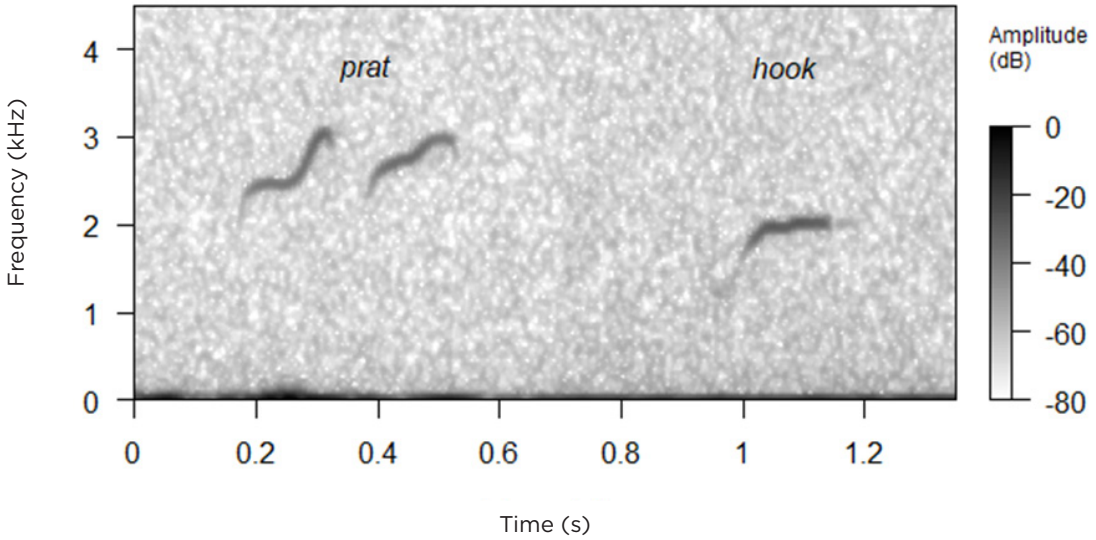

Figure 8. The *prat* call, only known from western Queensland, may be associated with breeding. The *hook* call has been detected only once, among a series of other calls recorded in the East Murchison.

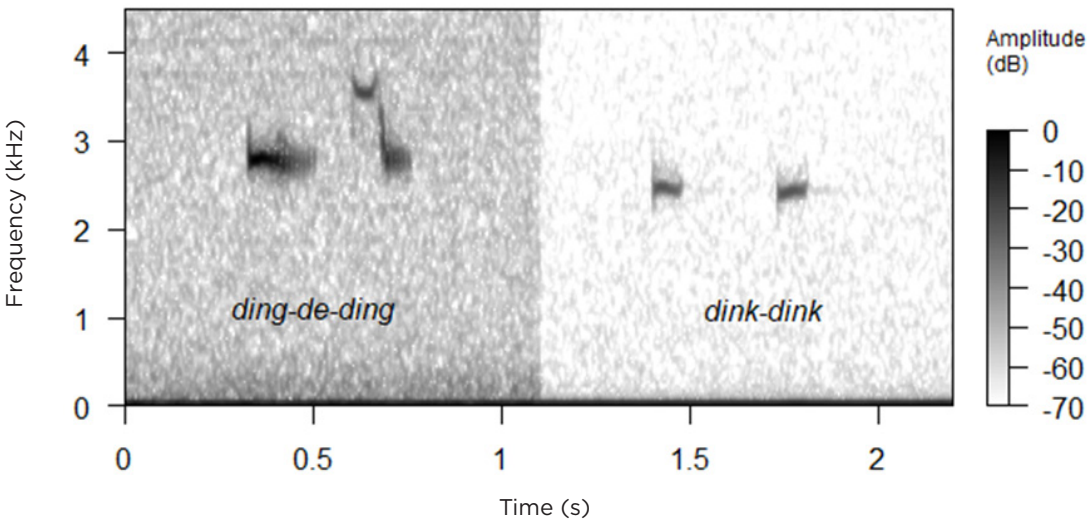

Figure 9. *Dink-dink* is a commonly heard call in western Queensland. *Ding-de-ding* is less commonly heard.

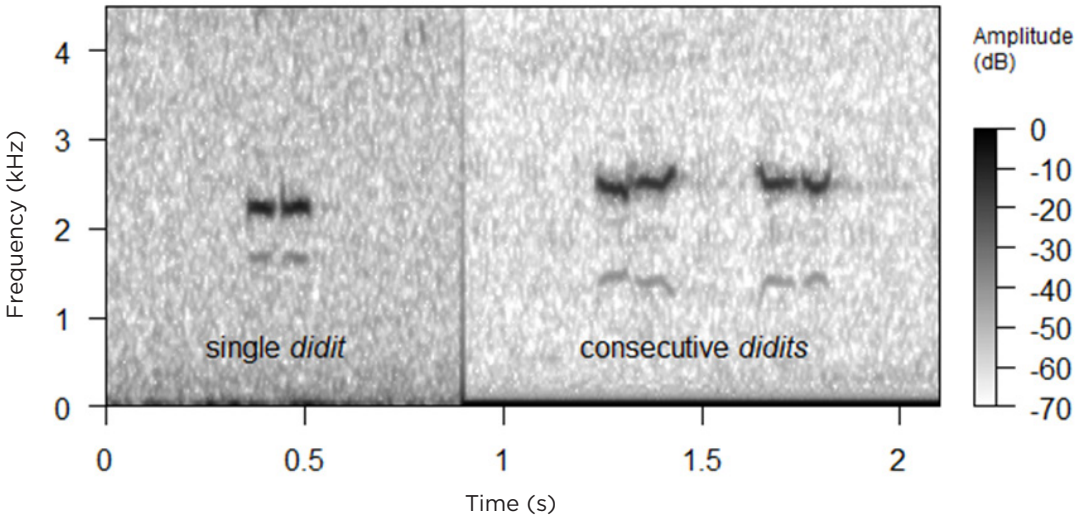

Figure 10. A single *didit* from the East Murchison on the left, and consecutive *didits* from the Great Sandy Desert on the right.

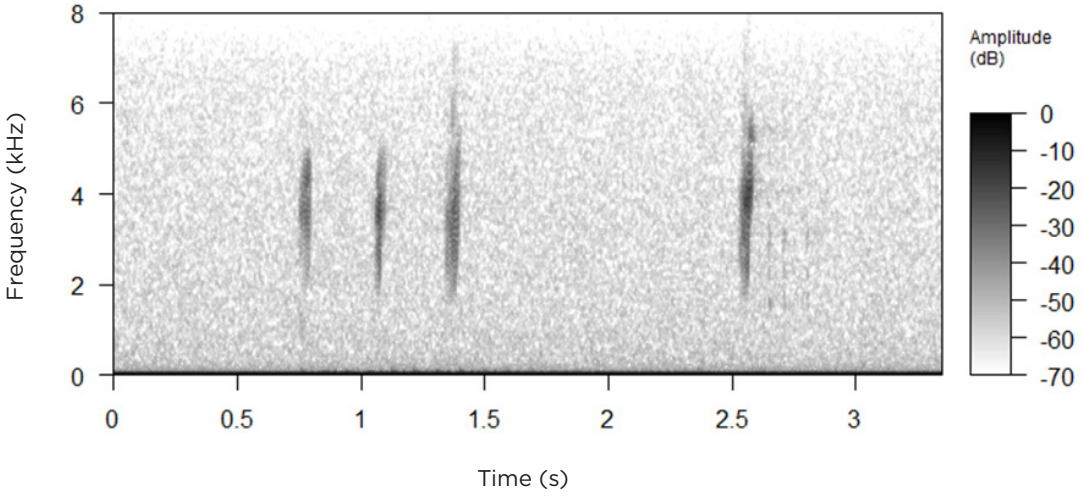

Figure 11. A sequence of *croak* calls from western Queensland. Sequences like this may last for up to several minutes.

Whinny

Nestlings are silent or at least very quiet until they reach an age of *c*. 2–3 weeks. They then commence begging and, like many young parrots, beg repeatedly when an adult is close to the nest or in the nest delivering food. The begging call is a high-pitched *whinny*. Young birds also give this call during the period immediately after fledging. The development of a begging call late in the nestling period has also been noted in ground parrots *Pezoporus* spp. (Courtney 1997).

Wheet

Wheet is another begging call, detected at one site where a pair of fledglings had apparently been out of the nest for *c*. 10–14 days based on plumage development. The fledglings could fly well, but remained in the nest area while the adults presumably left to forage. Given repeatedly, the call did not appear to be specifically in response to the proximity of the adults, although this is not certain. The call is a high-pitched *wheet*, given continually.

Discussion

The Night Parrot, like its closest relatives the Eastern and Western Ground Parrots, has a varied repertoire of vocalisations that is more diverse than for most parrots (Higgins 1999; Chan & Mudie 2004). For example, the genera *Neopsephotus* and *Neophema*, which are the two closest relatives of *Pezoporus* (Joseph *et al*. 2011; Schweizer *et al*. 2013), have generally limited repertoires consisting mainly of simple calls that vary little, either geographically or individually, across each species' range (Higgins 1999). Each species in the genus *Pezoporus* has evolved cryptic plumage and a secretive natural history associated with dense low vegetation. This apparently restricts the usual opportunities for social interaction by visual means available to other parrots, an order known for the birds' bright coloration and visually conspicuous social behaviour (Forshaw 1989; Toft & Wright 2015). It is therefore perhaps unsurprising that *Pezoporus* parrots have evolved varied vocal repertoires, which provide the means for their intraspecific interactions, rather than prominent visual displays. However, vocalisations in other parrots are relatively poorly known, and these species'

apparently varied repertoires may be the outcome of intense focus on vocalisations for this genus, given that this is the primary means of detection.

Although dialects exist within parrot species (Wright & Dahlin 2018), the amount of variation in Night Parrot vocalisations at such a small scale, as well as at a larger scale, seems unusual. Some calls, for example *croak* and *hollow whistle*, have been detected at each of the three sites and are apparently conserved across the species' range. Other calls, such as *ding-de-ding,* appear at this stage to be region specific, and some calls, such as *toot*, are only known from a single site. The *hollow whistle* and *one-* and *two-note trills* had not been recorded in the Channel Country before 2018, despite 5 years of intense research. Spatial and temporal variation in bird vocalisations may exist for several reasons, including social function, isolation or selection pressure, and similar fine-scale variation has been recorded in both Eastern and Western Ground Parrots (Newbey & Burbidge 2002; Chan & Mudie 2004). The reason for local variation in Night Parrot calls is unclear and requires further study, although it is possibly an artefact of the small sample size currently available.

The significant variation in call types at a relatively small scale also suggests that some Night Parrot calls are still unknown. Given that call-detection is probably the most suitable method for detecting and surveying Night Parrots, a detailed and accurate catalogue of calls from across the species' range is critical to clarifying the Parrot's true distribution and status and may help identify individuals. Filling the gaps in this current catalogue is a research priority, given the conservation status of the species.

Although most vocalisations of the Night Parrot are distinctive, the *hollow whistle* is very similar to the Pallid Cuckoo's hoarse whistle. Observers should therefore be cautious attributing *hollow whistle* calls to the Night Parrot. Although the traits outlined here are a guide to the possible species, even some strong *hollow whistle* calls cannot be definitely attributed to either species. A lack of reference calls for both species is inhibiting work on separating these two calls. Records of the Night Parrot based solely on the detection of this call should thus be treated as unconfirmed until corroborated through the detection of other known calls or additional evidence.

This research underlines the requirement to investigate vocalisations that may not precisely match the descriptions here, particularly if the context suggests that the call may be a Night Parrot. Flushing birds during the day should always be avoided, but confirmation can still be achieved with minimal disturbance through observations in and around the Parrot's roosting sites close to dusk, when they are known to become active, or the judicious use of call-playback. The discovery of the species in the East Murchison of Western Australia demonstrated the importance of ethically confirming the identification of possible Night Parrot calls. As a direct result of visually confirming that the unusual calls heard at the East Murchison site were in fact Night Parrots, this additional site where the species occurs in Western Australia was detected. However, it must be stressed that the purpose of any disturbance without the necessary research permits should be limited to identifying birds making unknown calls. Birds giving calls described herein are likely to be Night Parrots, should not be disturbed, and should be reported to the relevant state authorities and to the Night Parrot Recovery Team.

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